пропорционального обратимой проницаемости, U~(H), на образце размещалась катушка с двумя обмотками – возбуждающей и измерительной. Образец помещался в соленоид. К образцу прикладывалась упругая сжимающая нагрузка, величина которой контролировалась динамометром. На каждой ступени нагружения фиксировались кривые U~(H). Амплитуда переменного магнитного поля была много меньше максимального поля соленоида.

Экспериментально полученные зависимости, U~(H), при действии упругой сжимающей нагрузки были математически обработаны с помощью двух разных способов. Оба подхода позволяют разделить вклад 90- и 180-градусных доменных границ в процессы перемагничивания. Показано, что средние значения полей максимумов, $H_{ср}$, полученные двумя методами, хорошо коррелируют с величиной приложенных напряжений. А результаты, полученные с помощью двух этих подходов, достаточно близки. Были подтверждены результаты, полученные ранее в работе [2]. Установлены достоинства и недостатки каждого метода.

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ESTIMATION OF TEMPERATURE AND THERMAL PRESSURES IN THERMALIZED AREAS OF DENSE CASCADES OF ATOMIC DISPLACEMENTS IN THE COURSE OF ION BOMBARDEMENT

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The glow of the various substances surface under the influence of beams of accelerated ions in the optical wavelength range was observed by many authors. None of the theoretical models proposed so far, which can be arbitrarily divided into thermodynamic, molecular, detachment, and collisional [1], can explain all the features of the type of emission under consideration and describe its spectrum.

In this regard, to explain the presence of a continuous spectrum, we can assume that we are dealing with some equilibrium (in other words, thermal) or, at least, quasi-equilibrium radiation. This may be, for example, the radiation of “thermal spikes”, formed in the case of irradiation with low and medium energy ions (from 1 to 100 keV),

directly near the surface of solids [2], as a result of the evolution of dense cascades of atomic collisions.

This means that the radiation from thermal spikes formed in areas of unbranched cascades of atomic displacements located at the above-mentioned energies at a depth, not exceeding the depth of penetration of visible radiation into metals (which has the order of λ / 2, λ is the radiation wavelength) and heated, according to molecular dynamic estimates, to several thousand Kelvin degrees [2,3] can be experimentally observed and studied its features.

In order to test this hypothesis, we analyzed the spectral composition of the luminescence of the surface of pure metals (Fe, Zr, W, Ta) in the course of bombardment with Ar^+ and Xe^+ ions with energies E = 5–20 keV. It was supposed to compare the change in experimental and calculated on the basis of the theory temperature values in the region of thermal spikes with variations in the energy and mass of accelerated ions, in order to obtain information about the nature of the analyzed processes.

Assuming that a quasi-equilibrium state is reached in the region of thermalized dense cascades of atomic displacements (thermal spikes), their temperature for various metals was estimated in [2] depending on the irradiation parameters

In this work, we confirmed the results [2] of an experimental determination of the temperature of thermal spikes in pure metals: Fe, W, and Zr in the case of their irradiation with Ar^+ ions. In addition, assuming the thermal nature of the emission of targets in the process of ion bombardment, based on the analysis of the emission spectra, using the Wien displacement law:

$$\lambda_{max} = \frac{b}{T} \quad (1),$$

where b is the Wien constant, the temperatures of thermal spikes in Fe, W, Zr and pure Ta were obtained, when they were irradiated not only with Ar^+, but also with Xe^+ ions.

Thermal pressures in the areas of thermal spikes are estimated to reach values from several units to several tens of GPa.

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